CLAIMS

We claim:

1. A tunable resonant system, comprising:

a resonant cavity apparatus including at least one cavity wall made of a conductive material and arranged to form a resonant cavity;

a fluidic dielectric disposed within said resonant cavity; and

a fluid control system for selectively varying a composition of said fluidic dielectric to dynamically modify a frequency response of said resonant cavity.

2. The tunable resonant system according to claim 1 further comprising at least one slot located in said at least one cavity wall for coupling energy into and out of said resonant cavity.

3. The tunable resonant system according to claim 1 wherein said fluid control system varies said composition to modify at least one electrical characteristic of said fluidic dielectric.

4. The tunable resonant system according to claim 3 wherein said electrical characteristic is selected from the group consisting of a relative permittivity, a relative permeability and a loss tangent.

5. The tunable resonant system according to claim 4 wherein said frequency response is modified to vary at least one of a center frequency, a bandwidth, a quality factor (Q) and an impedance of said resonant cavity.

6. The tunable resonant system according to claim 1 wherein said fluid control system selectively varies said composition of said fluidic dielectric to maintain constant at least one parameter of said frequency response when a second parameter of said frequency response is varied.

7. The tunable resonant system according to claim 1 wherein said fluid control system selectively varies said composition of said fluidic dielectric to compensate for mechanical variations of said resonant cavity.

8. The tunable resonant system according to claim 1 wherein said conductive material is comprised of a material selected from the group consisting of steel, brass, copper, ferrite, and iron-nickel alloy.

9. The tunable resonant system according to claim 1 wherein said fluid control system further comprises a composition processor for dynamically mixing together a plurality of component parts to form said fluidic dielectric.

10. The tunable resonant system according to claim 9 wherein said component parts are selected from the group consisting of (a) a low permittivity, low permeability component, (b) a high permittivity, low permeability component, and (c) a high permittivity, high permeability component.

11. A method for dynamically controlling a frequency response of a resonant cavity comprising the steps of:

producing a first frequency response for said resonant cavity by disposing within said resonant cavity a fluidic dielectric; and

selectively modifying a composition of said fluidic dielectric in response to a control signal to produce a second frequency response different from said first frequency response.

12. The method according to claim 11 further comprising the step of coupling RF energy into and out of said resonant cavity.

13. The method according to claim 11 further comprising the step of varying said composition to modify at least one electrical characteristic of said fluidic dielectric.

14. The method according to claim 13 further comprising the step of selecting said electrical characteristic from the group consisting of a relative permittivity, a relative permeability and a loss tangent.

15. The method according to claim 14 further comprising the step of modifying said frequency response to vary at least one of a center frequency, a bandwidth, a quality factor (Q) and an impedance of said resonant cavity.

16. The method according to claim 11 further comprising the step of selectively automatically varying said composition to maintain constant at least one parameter of said frequency response when a second parameter of said frequency response is varied.

17. The method according to claim 11 further comprising the step of automatically varying said composition of said fluidic dielectric to compensate for mechanical variations of said resonant cavity.

18. The method according to claim 11 further comprising the step of selecting a material for said conductive boundary walls selected from the group consisting of steel, brass, copper, ferrite, and iron-nickel alloy.

19. The method according to claim 11 further comprising the step of dynamically mixing together a plurality of component parts to form said fluidic dielectric.

20. .The method according to claim 19 wherein said component parts are selected from the group consisting of (a) a low permittivity, low permeability component, (b) a high permittivity, low permeability component, and (c) a high permittivity, high permeability component.